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(54) **ADJUSTABLE GUARD FOR POWER TOOL**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,911,471 A 5/1933 Sacrey
2,104,436 A 1/1938 Pattison et al.
2,377,271 A 5/1945 Schumann
2,452,268 A 10/1948 Schumann
2,546,846 A 3/1951 Atkin
2,746,220 A 5/1956 Thomas
3,413,498 A 11/1968 Bowen, III et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP 236537 9/1987
JP 2003246208 9/2003

OTHER PUBLICATIONS

Radnor Brand Grinder Instruction Manual, <http://airgas.com/documents/pdf/SpecSheet/N-R/RAD_Radnor/instructman%20radnorneutrix.pdf> 2010, 12 pages.

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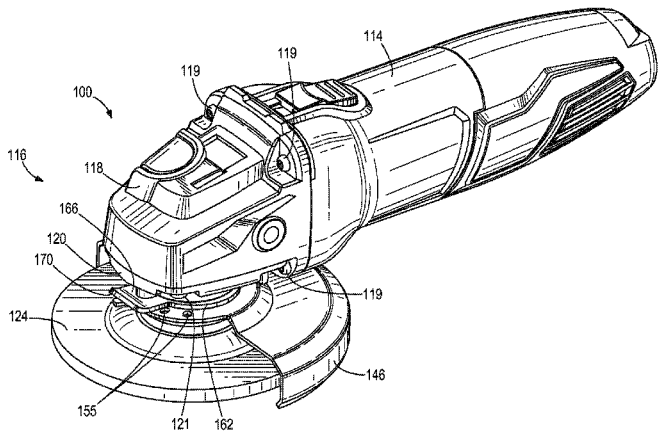
(57) **ABSTRACT**

A power tool includes an output shaft defining a rotational axis and a housing from which the output shaft protrudes. The power tool further includes a flange at least partially surrounding the output shaft, a circumferential groove defined between the housing and the flange, and a radially inward-extending slot in the flange. The power tool also includes a rotatable guard having a first radially inward-extending projection and a plurality of apertures positioned radially about the rotational axis. The first radially inward-extending projection is receivable through the radially inward-extending slot in the flange and positioned within the groove. Furthermore, the power tool includes a lever having a detent member, and a biasing member for biasing the lever toward the rotatable guard. The detent member is receivable in one of the plurality of apertures to rotationally lock the rotatable guard relative to the housing.

20 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

3,464,165 A 9/1969 Meredith
3,476,960 A 11/1969 Rees
3,574,975 A 4/1971 Liss
3,618,994 A 11/1971 Gepfert et al.
3,742,655 A 7/1973 Oliver
3,829,722 A 8/1974 Rosenthal, Jr. et al.
3,907,257 A 9/1975 Drzewiecki
3,940,818 A 3/1976 Anderson
4,130,770 A 12/1978 Wrobel
4,526,024 A 7/1985 Toti
4,574,532 A 3/1986 Häberle et al.
4,612,734 A 9/1986 Nakajima et al.
4,810,919 A 3/1989 Ponce et al.
4,920,702 A 5/1990 Kloss et al.
4,924,635 A * 5/1990 Rudolf B24B 55/052 451/344
4,962,617 A 10/1990 Tilders et al.
4,976,071 A 12/1990 Stäbler
5,005,321 A * 4/1991 Barth B24B 55/052 451/359
5,020,280 A 6/1991 O'Reilly
5,030,028 A 7/1991 Riviera et al.
5,076,030 A 12/1991 Schwab et al.
5,144,175 A 9/1992 Craggs
5,157,873 A 10/1992 Rudolf et al.
5,163,252 A 11/1992 Garner et al.
5,311,089 A 5/1994 Stroetgen et al.
5,315,193 A 5/1994 Kummer et al.
5,319,889 A 6/1994 Rudolf et al.
5,384,985 A 1/1995 Jacobsson
5,386,667 A * 2/1995 Hausslein B24B 55/052 451/344
D368,772 S 4/1996 Liao
5,558,571 A 9/1996 Toyoshima et al.
5,601,483 A 2/1997 Rudolf et al.
5,632,578 A 5/1997 McCurry et al.
5,634,274 A 6/1997 Ohkouchi et al.
5,637,035 A * 6/1997 Yee B23Q 11/08 144/251.2
5,766,062 A 6/1998 Edling
5,947,671 A 9/1999 Kanaan et al.
6,004,194 A 12/1999 Hild et al.
D421,798 S 3/2000 Liang
D423,155 S 4/2000 Paynter et al.
6,048,260 A 4/2000 Kopras
RE36,909 E 10/2000 Satos
D433,906 S 11/2000 Heun
D456,234 S 4/2002 Keller
D456,685 S 5/2002 Keller
D458,825 S 6/2002 Keller et al.
6,464,573 B1 10/2002 Keller
6,569,001 B2 5/2003 Rudolf et al.
D483,467 S 12/2003 Horng et al.
6,814,655 B2 11/2004 Hofmann
6,848,985 B2 2/2005 Lamprecht et al.
6,921,236 B2 7/2005 Rahberger
6,942,560 B2 9/2005 Hofmann
6,949,017 B2 * 9/2005 Koschel B24B 55/052 451/358
D511,285 S 11/2005 Henssler
D511,824 S 11/2005 Chen et al.
7,059,947 B2 6/2006 Crover
7,077,734 B2 7/2006 Tiede
7,077,736 B2 7/2006 Uzumcu et al.
7,131,897 B2 11/2006 Crover
7,157,818 B2 1/2007 Jones
7,175,513 B2 2/2007 Folin
7,252,581 B2 8/2007 Numata et al.
7,258,173 B2 8/2007 Hammerstingl et al.
D553,933 S 10/2007 Esenwein
7,300,262 B2 11/2007 Ku et al.
D558,324 S 12/2007 Hong
7,332,838 B2 2/2008 Akiba
D574,077 S 7/2008 Horng et al.
7,510,465 B2 3/2009 Chung et al.
7,524,239 B2 4/2009 Schmidberger-Brinek et al.
7,567,001 B2 7/2009 Kasai et al.
7,719,146 B2 5/2010 Takahashi et al.
7,722,444 B2 5/2010 Gallagher et al.
7,732,955 B2 6/2010 Miller et al.
7,768,750 B2 8/2010 Uchida
7,786,627 B2 8/2010 Riedl
7,794,305 B2 9/2010 Nelson
7,892,075 B2 * 2/2011 Esenwein B24B 23/028 451/344
D633,928 S 3/2011 Nilsson
D634,170 S 3/2011 Hu et al.
D634,833 S 3/2011 Stagg
7,909,680 B2 3/2011 Boeck et al.
7,927,191 B2 4/2011 Esenwein
D637,057 S 5/2011 Schomisch
7,955,162 B2 6/2011 Boeck et al.
7,988,538 B2 8/2011 Trautner et al.
D644,898 S 9/2011 Okuda
D647,772 S 11/2011 Hayakawa
D651,062 S 12/2011 Wack
D651,499 S 1/2012 Tong
D651,874 S 1/2012 Davidian
D651,875 S 1/2012 Davidian
D651,876 S 1/2012 Davidian
D651,877 S 1/2012 Davidian
D651,878 S 1/2012 Davidian
D652,274 S 1/2012 Davidian
8,087,475 B2 1/2012 Habel et al.
8,087,977 B2 1/2012 Gallagher et al.
8,096,857 B2 1/2012 Hofmann et al.
8,113,922 B2 2/2012 Esenwein
8,123,596 B2 2/2012 Kobayashi et al.
D660,119 S 5/2012 Fukumoto et al.
8,221,197 B2 7/2012 Boeck et al.
8,231,436 B2 7/2012 Boeck et al.
8,246,425 B2 8/2012 Schudel
D669,754 S 10/2012 Wackwitz
8,282,446 B2 10/2012 Sulea et al.
8,292,700 B2 10/2012 Gallagher et al.
8,425,282 B2 4/2013 Woods et al.
8,454,411 B2 6/2013 Boeck et al.
8,454,412 B2 6/2013 Esenwein
D685,240 S 7/2013 Waldron
D685,241 S 7/2013 Waldron
D694,076 S 11/2013 Davidian
D694,597 S 12/2013 Davidian
D694,598 S 12/2013 Davidian
D694,599 S 12/2013 Davidian
D697,384 S 1/2014 Wackwitz
D707,517 S 6/2014 Aglassinger
D708,031 S 7/2014 Aglassinger
D709,341 S 7/2014 Nispel
D710,170 S 8/2014 Aglassinger
D710,171 S 8/2014 Aglassinger
D715,616 S 10/2014 Aglassinger
D724,923 S 3/2015 McRoberts
D735,568 S 8/2015 Barnett
D746,118 S 12/2015 Xu
2004/0138668 A1 7/2004 Fisher
2005/0282474 A1 12/2005 Jones
2008/0153404 A1 * 6/2008 Schmidberger-Brinek B24B 55/052 451/359
2009/0179507 A1 7/2009 Tanimoto
2009/0293696 A1 12/2009 Rauscher et al.
2010/0026107 A1 2/2010 Hosokawa
2010/0056029 A1 3/2010 Grunikiewicz
2010/0102654 A1 4/2010 Lange et al.
2010/0105300 A1 4/2010 Esenwein
2010/0123359 A1 5/2010 Nishikawa
2010/0132968 A1 6/2010 Hartmann
2010/0178857 A1 7/2010 Esenwein
2010/0304648 A1 12/2010 Boeck et al.
2011/0001368 A1 1/2011 Lau
2011/0025142 A1 2/2011 Bernhardt et al.
2011/0171887 A1 7/2011 Tanimoto et al.
2011/0195643 A1 * 8/2011 Dai B24B 55/05 451/359

(56) **References Cited**

U.S. PATENT DOCUMENTS

2011/0241457	A1	10/2011	Müller et al.	
2011/0281507	A1	11/2011	Trautner et al.	
2012/0080963	A1	4/2012	Yoshikawa	
2012/0184191	A1	7/2012	Schulze	
2012/0231710	A1	9/2012	Boeck et al.	
2012/0270480	A1*	10/2012	Rohde	B23D 45/16 451/451
2013/0090045	A1	4/2013	Meyer	

* cited by examiner

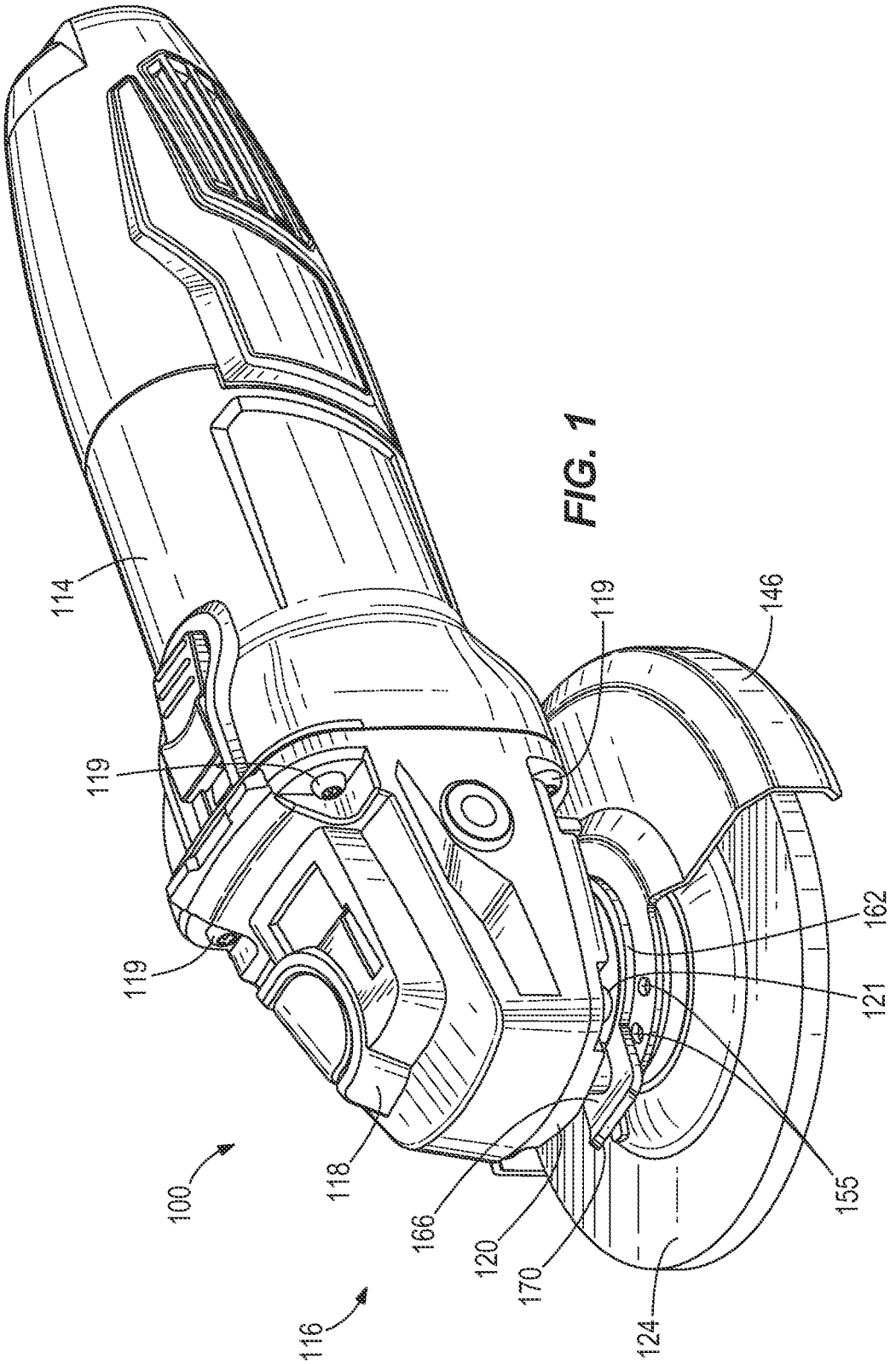


FIG. 1

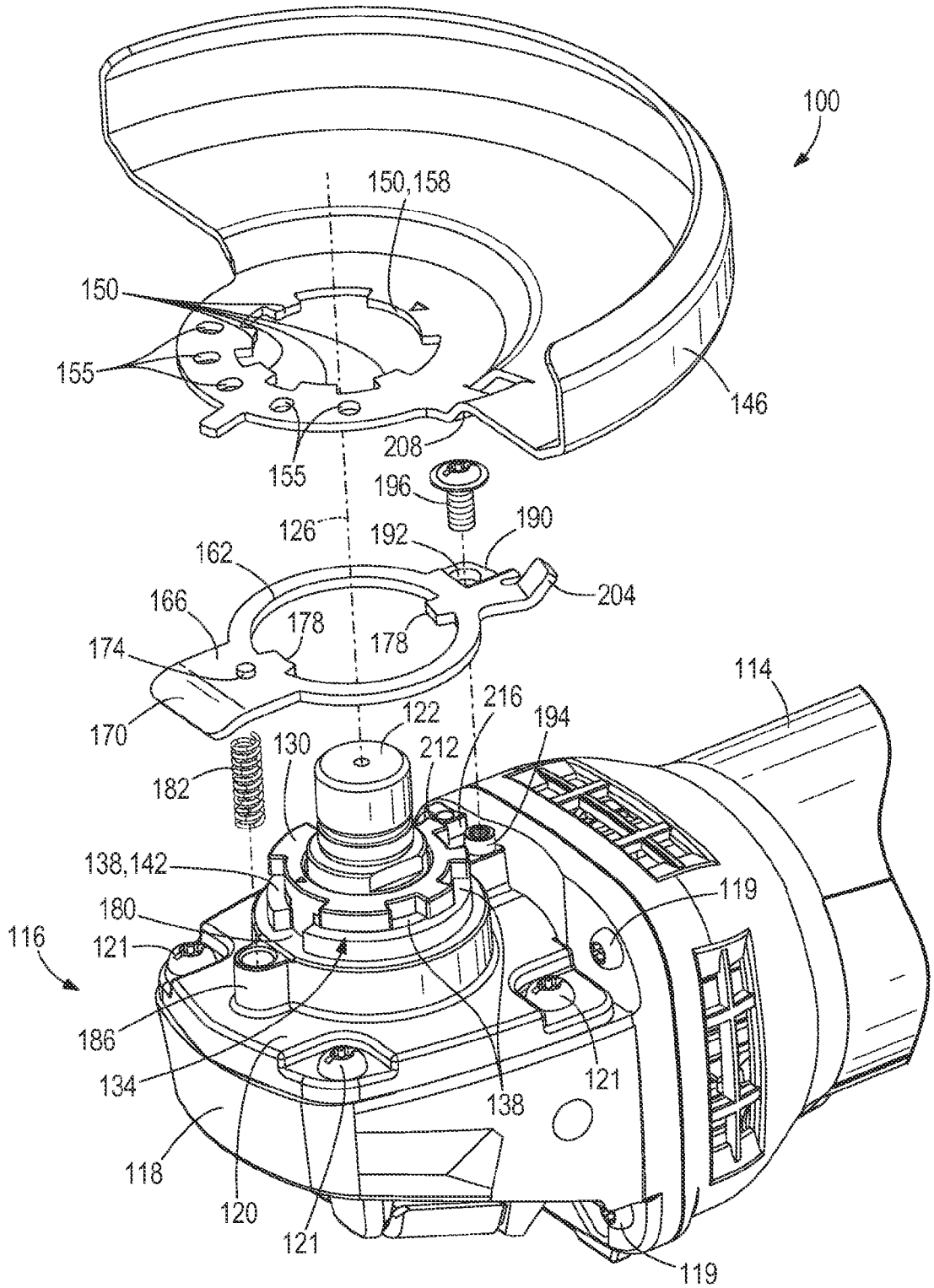

100
150,158
150
155
146
208
155
196
126
192
190
162
204
166
178
178
174
170
114
122
216
194
130
212
182
138,142
119
180
116
121
186
134
121
138
118
120
121
119

FIG. 2

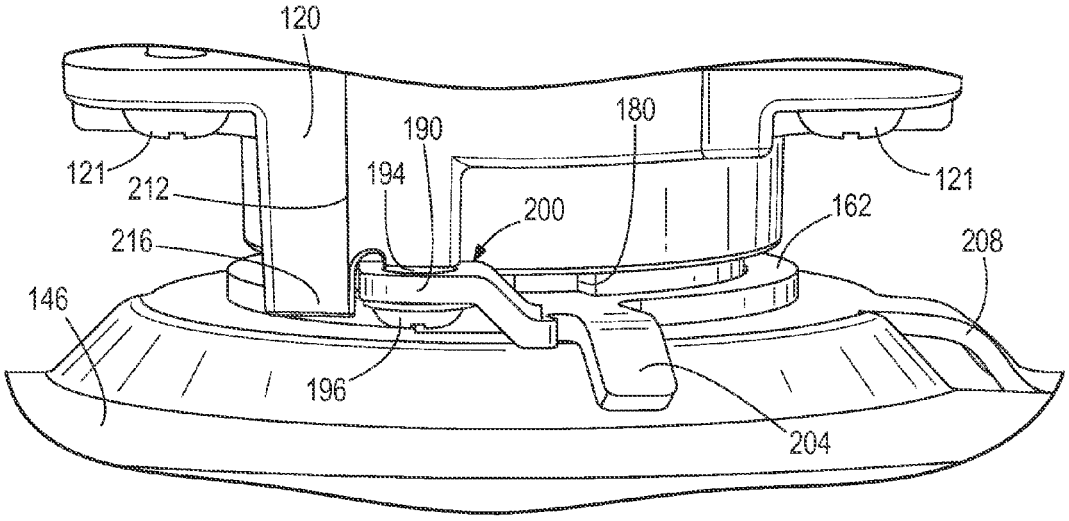

120
121
212
190
194
180
200
162
121
216
208
146
196
204

FIG. 3

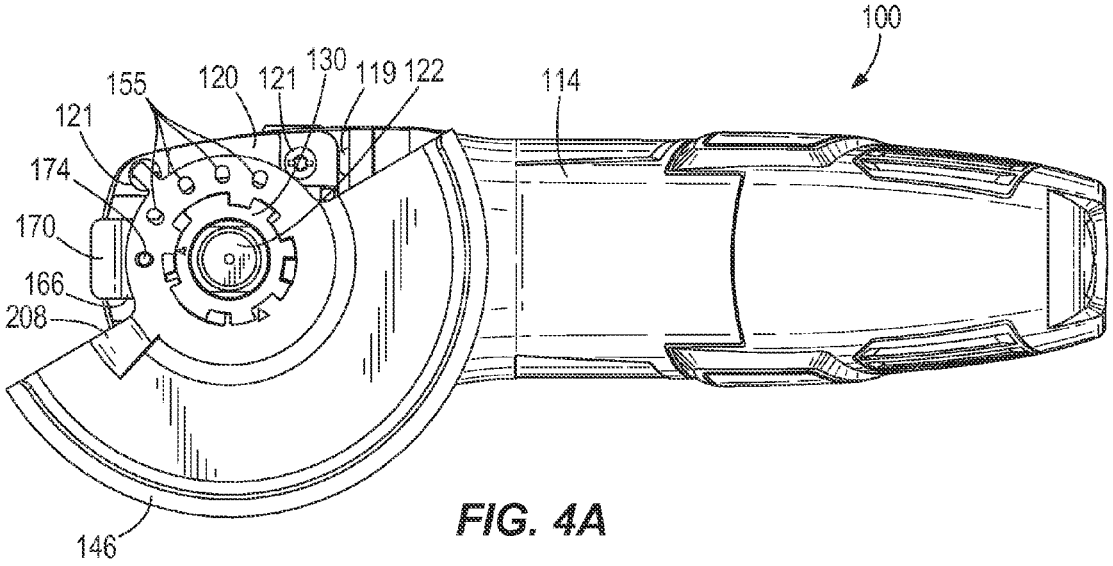

100
155
120
121
130
119
122
114
121
174
170
166
208
146

FIG. 4A

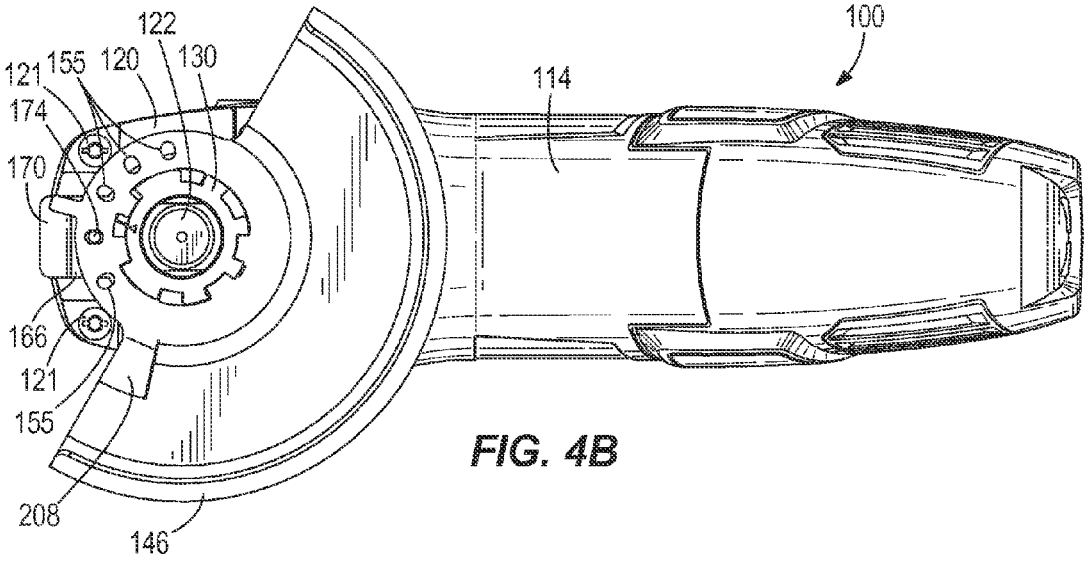

122
121
155
120
130
174
170
166
121
155
208
146
114
100

FIG. 4B

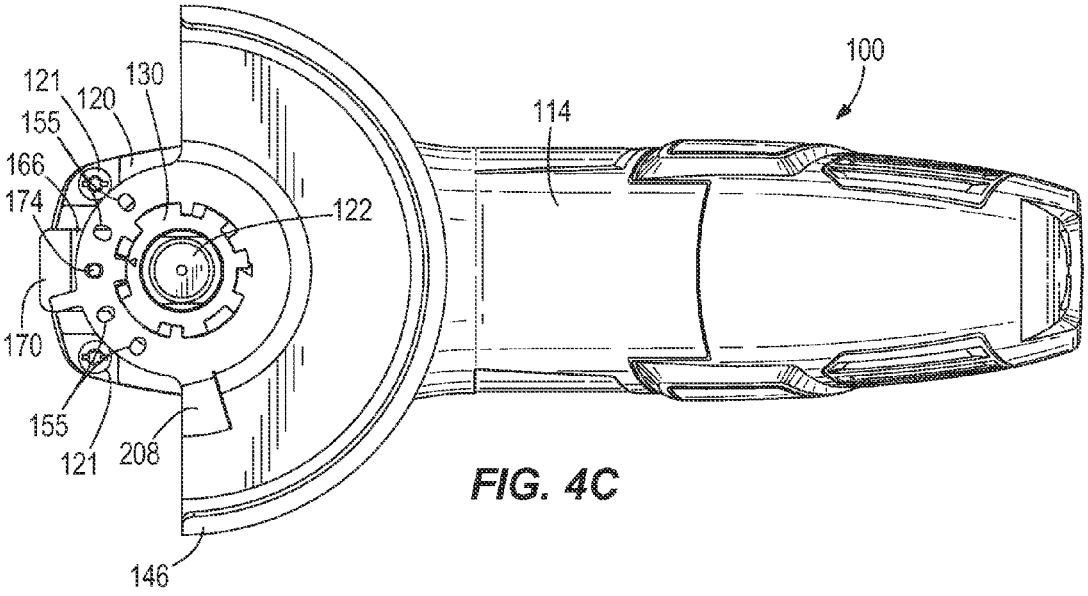

121
120
130
155
166
174
122
170
155
121
208
146
114
100

FIG. 4C

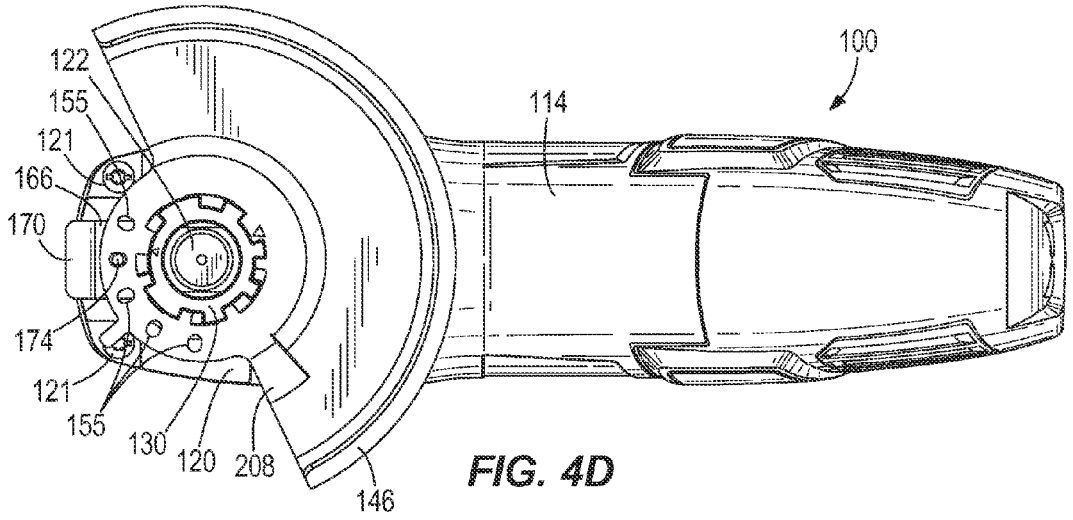

122
155
121
166
170
174
121
155
130
120
208
146
114
100

FIG. 4D

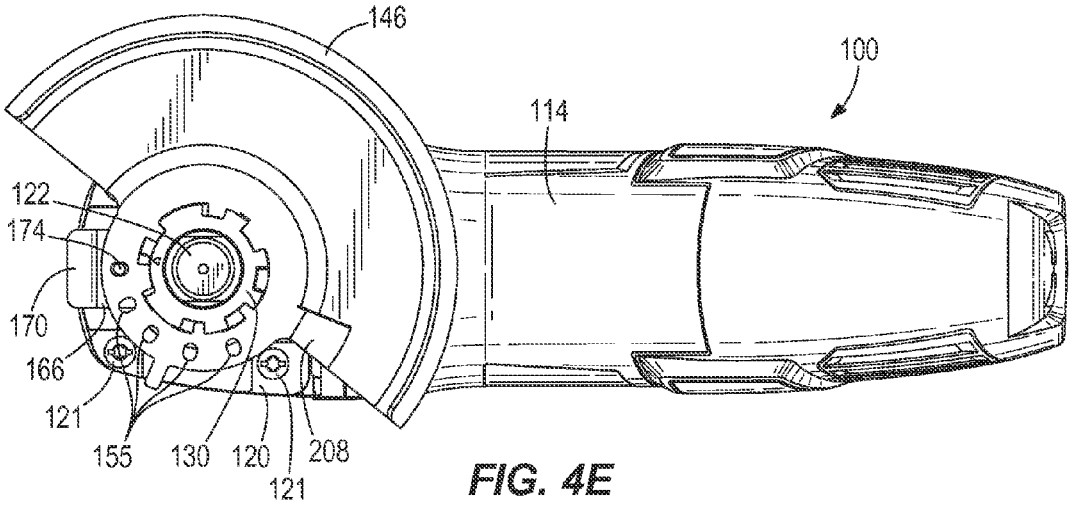

146
100
114
122
174
170
166
121
155
130
120
208
121

FIG. 4E

ADJUSTABLE GUARD FOR POWER TOOL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 62/024,848 filed on Jul. 15, 2014, the entire contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to guards for hand-held power tools, and more particularly to adjustable guards.

BACKGROUND OF THE INVENTION

Power tools, such as hand-held angle grinders, include rotating abrasive tool elements that create debris during operation on a workpiece. A guard can shield a user of the power tool from such debris created during operation. However, guards may be non-adjustable, or difficult to adjust, and may block the user's view of the workpiece.

SUMMARY OF THE INVENTION

The invention provides, in another aspect, a power tool comprising an output shaft defining a rotational axis and a housing from which the output shaft protrudes. The power tool further includes a flange at least partially surrounding the output shaft, a circumferential groove defined between the housing and the flange, and a radially inward-extending slot in the flange. The power tool also includes a rotatable guard having a first radially inward-extending projection and a plurality of apertures positioned radially about the rotational axis. The first radially inward-extending projection is receivable through the radially inward-extending slot in the flange and positioned within the groove. Furthermore, the power tool includes a lever having a detent member, and a biasing member for biasing the lever toward the rotatable guard. The detent member is receivable in one of the plurality of apertures to rotationally lock the rotatable guard relative to the housing.

Other aspects of the invention will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a power tool in accordance with an embodiment of the invention.

FIG. **2** is an exploded perspective view of the power tool of FIG. **1**, illustrating a rotatable guard and a lever for adjusting the rotational position of the guard.

FIG. **3** is an assembled, perspective view of the power tool of FIG. **1**, illustrating a final stop feature on the rotatable guard of FIG. **1**.

FIG. **4**A is an assembled, bottom view of the power tool of FIG. **1** illustrating the rotatable guard in a first rotational position.

FIG. **4**B is an assembled, bottom view of the power tool of FIG. **1** illustrating the rotatable guard in a second rotational position.

FIG. **4**C is an assembled, bottom view of the power tool of FIG. **1** illustrating the rotatable guard in a third rotational position.

FIG. **4**D is an assembled, bottom view of the power tool of FIG. **1** illustrating the rotatable guard in a fourth rotational position.

FIG. **4**E is an assembled, bottom view of the power tool of FIG. **1** illustrating the rotatable guard in a fifth rotational position.

Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

DETAILED DESCRIPTION

FIG. **1** illustrates a hand-held power tool **100** (i.e., an angle grinder) including a motor housing **114**, a gear housing **116** having a gear case **118** and a gear case cover **120**, and an output shaft **122** extending from the gear housing **116** along a rotational axis **126** (FIG. **2**). The output shaft **122** is driven by a motor positioned within the motor housing **114** and a gear train positioned within the gear housing **116**. The gear case **118** is secured to the motor housing **114** via fasteners **119**, and the gear case cover **120** is secured to the gear case **118** via fasteners **121**. A grinding disc **124** (shown only in FIG. **1**) is coupled to the output shaft **122** for co-rotation therewith about the rotational axis **126**.

With reference to FIG. **2**, the tool **100** also includes a flange **130** extending from the gear case cover **120** and surrounding the output shaft **122**. The flange **130** includes six radially inward-extending slots **138** and defines a circumferential groove **134** in conjunction with the gear case cover **120**. One of the slots **138** is an enlarged slot **142** used for alignment purposes as explained in detail below. In other embodiments of the tool **100**, the flange **130** may include more or fewer slots **138**.

With continued reference to FIG. **2**, the tool **100** further includes a removable and rotatable guard **146** for partially covering the grinding disc **124** (not shown in FIGS. **2**-**4**E for clarity). The guard **146** includes six radially inward-extending projections **150** and five apertures **155** positioned radially about the rotational axis **126**. One of the projections **150** is an enlarged projection **158**, corresponding to the enlarged slot **142** on the flange **130**. The projections **150** on the guard **146** are receivable through the slots **138** in the flange **130** with the enlarged projection **158** corresponding to the enlarged slot **142**. The guard **146** is rotated about the rotational axis **126** to position the projections **150** within the groove **134**, thereby axially securing the guard **146** to the gear housing **116**. The guard **146** is thereby removable from the groove **134** only when the enlarged projection **158** aligns with the enlarged slot **142**.

Referring still to FIG. **2**, the tool **100** further includes a latch plate **162** for rotationally locking the guard **146** into place relative to the gear housing **116**. The latch plate **162** includes a detent lever **166**, an actuating portion **170**, and a detent member **174**. The latch plate **162** further includes two radially inward-extending tabs **178** received within axial channels **180** formed in the gear case cover **120** to properly orient the latch plate **162** between the gear case cover **120** and the guard **146** and to prevent rotation of the latch plate **162** about the axis **126**. A coil spring **182** is coupled to a spring seat **186** and biases the detent lever **166** toward the

rotatable guard **146**. In the illustrated embodiment, the spring seat **186** is a recess and the coil spring **182** is positioned within the spring seat **186**. In alternative embodiments, the spring seat may be a post and the coil spring may be positioned and seated around the post. The detent member **174** is receivable in one of the five apertures **155** in the guard **146** to rotationally lock the guard **146** relative to the gear housing **116**. The detent lever **166** is biased by the spring **182** to position the detent member **174** in one of the apertures **155** in the blade guard **146** upon installation of the guard **146** onto the gear case cover **120** as described above. The detent member **174** is removed from one of the apertures **155** in the guard **146** by applying a force to the actuating portion **170** of the detent lever **166** directed away from the guard **146**. The applied force displaces the detent member **174** from one of the aperture **155**, after which time the guard **146** is free to rotate about the rotational axis **126** to a different rotational position relative to the gear housing **116**. Upon releasing the actuating portion **170**, the spring **182** biases the detent member **174** back toward the guard **146**, thereby positioning the detent member **174** into the next aperture **155** that it encounters as rotation of the guard **146** continues to a desired position.

With reference to FIGS. **2** and **3**, the latch plate **162** further includes a mounting tab **190** that is coupled to a boss **194** formed on the gear case cover **120**. More specifically, the boss **194** is received within an aperture **192** formed in the mounting tab **190**, and a fastener **196** secures the mounting tab **190** around the boss **194**. The fastener **196** abuts the end of the boss **194**, thereby creating a gap **200** within which the mounting tab **190** can move with respect to the boss **194**. The gap **200** permits the latch plate **162** to teeter during actuation of the detent lever **166** to remove the detent member **174** from one of the apertures **155**.

The latch plate **162** further includes a stop finger **204** that cooperates with a corresponding final stop projection **208** extending from an upper surface of the guard **146**. The final stop projection **208** prevents over-rotation of the guard **146** regardless of whether the detent member **174** is received in one of the apertures **155**. The final stop projection **208** abuts the stop finger **204** of the latch plate **162** to prevent more than a predetermined amount of rotation (e.g., 180 degrees) of the guard **146** relative to the gear housing **116** from occurring should, for example, the grinding disc **124** shatter during use of the tool **100**. The gear case cover **120** includes a bulkhead **212**, which provides additional reinforcement and strength to the gear case cover **120**, having a bumper portion **216** for absorbing an impact between the final stop projection **208** and stop finger **204**. In the illustrated embodiment, the bumper portion **216** is circumferentially adjacent the mounting tab **190** of the latch plate **162**, such that any circumferential impact transferred to the latch plate **162** is absorbed by the bumper portion **216**. The bumper portion **216** is positioned at least in part for preventing a complete rotation of the latch plate **162**, as required by UL 60745-2-3, should the boss **194** and fastener **196** be sheared from an impact between the final stop projection **208** and the stop finger **204**. In alternative embodiments, the particular features described above as formed on the gear case cover **120** (e.g., the bulkhead **212**, the spring seat **186**, the groove **134**, etc.) may be formed on the gear case **118**. In further alternative embodiments, the gear case cover **120** may be an integral component of the gear case **118**. In further alternative embodiments, the gear case **118** may be integrally formed with the motor housing **114**.

With reference to FIGS. **4**A-**4**E, the rotatable guard **146** is shown rotatably locked by the latch plate **162** in five different positions, one position for each of the five apertures **155**. In other words, the detent member **174** is received in a different one of the apertures **155** in each of FIGS. **4**A-**4**E. The user selects or adjusts the position of the guard **146** by pulling upward on the actuating portion **170** (from the frame of reference of FIG. **1**), rotating the guard **146** to any of the positions shown in FIGS. **4**A-**4**E, and then releasing the latch plate **162**, thereby allowing the spring **182** to again bias the detent member **174** toward the guard **146** for insertion into another of the apertures **155** corresponding with the chosen orientation of the guard **146** in any of FIGS. **4**A-**4**E to rotationally lock the guard **146** to the gear housing **116** again.

Various features and advantages of the invention are set forth in the following claims.

What is claimed is:

1. A power tool comprising:
- an output shaft defining a rotational axis;
- a housing from which the output shaft protrudes;
- a flange at least partially surrounding the output shaft;
- a circumferential groove defined between the housing and the flange;
- a radially inward-extending slot in the flange;
- a rotatable guard including a first radially inward-extending projection and a plurality of apertures positioned radially about the rotational axis, the first radially inward-extending projection is receivable through the radially inward-extending slot in the flange and positioned within the groove;
- a lever including a detent member; and
- a biasing member for biasing the lever toward the rotatable guard;
- wherein the detent member is receivable in one of the plurality of apertures to rotationally lock the rotatable guard relative to the housing.

2. The power tool of claim **1**, wherein the radially inward-extending slot is a first radially inward-extending slot, and wherein the power tool further includes a second radially inward-extending slot in the flange.

3. The power tool of claim **2**, further including a second radially inward-extending projection on the rotatable guard.

4. The power tool of claim **3**, wherein the second radially inward-extending projection is receivable through the second radially inward-extending slot in the flange and positioned within the groove.

5. The power tool of claim **4**, wherein the first radially inward-extending projection is larger than the second radially inward-extending projection, and wherein the first radially inward-extending slot is larger than the second radially inward-extending slot.

6. The power tool of claim **1**, wherein the rotatable guard is removable from the housing.

7. The power tool of claim **6**, wherein removing the rotatable guard from the housing includes aligning the first radially inward-extending projection with the radially inward-extending slot.

8. The power tool of claim **1**, wherein the biasing member is coupled to a seat formed on the housing.

9. The power tool of claim **1**, further comprising a latch plate upon which the lever and the detent member are integrally formed.

10. The power tool of claim **9**, wherein the latch plate circumferentially surrounds the output shaft.

11. The power tool of claim **9**, wherein the latch plate further includes a radially inward-extending tab that is received within a corresponding axial channel formed in the housing.

12. The power tool of claim 9, wherein the latch plate further includes a mounting tab that is coupled to a boss formed on the housing.

13. The power tool of claim 12, wherein the mounting tab includes an aperture through which the boss is received, and wherein the power tool further includes a fastener anchored to the boss for securing the mounting tab in position around the boss.

14. The power tool of claim 13, wherein a head of the fastener abuts an end of the boss to create a gap between the fastener head and the end of the boss, and wherein the mounting tab is positioned within the gap for movement with respect to the boss.

15. The power tool of claim 14, wherein the gap permits the latch plate to teeter during actuation of the lever to remove the detent member from one of the plurality of apertures.

16. The power tool of claim 9, wherein the latch plate further includes a stop, and wherein the rotatable guard further includes a final stop projection.

17. The power tool of claim 16, wherein the stop and the final stop projection abut to prevent more than a predetermined amount of rotation of the guard with respect to the housing.

18. The power tool of claim 17, wherein the housing further includes a bumper portion operable to absorb an impact between the stop and the final stop projection.

19. The power tool of claim 18, wherein the bumper portion is circumferentially adjacent a mounting tab of the latch plate.

20. The power tool of claim 1, wherein the power tool is configured as a right-angle grinder.

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